

REVISION OF *PRELISSORHYNCHIA* XU & GRANT, 1994 (BRACHIOPODA) FROM THE UPPER PERMIAN OF SOUTH CHINA

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A revision of the genus *Prelissorhynchia* Xu & Grant, 1994 is carried out based on an examination of the type material of '*Pugnax*' *pseudoutah* Huang (1933) from the Late Permian of South China. The systematic study of the South Chinese specimens shows that specimens previously assigned to Huang's species should be divided into two genera: *Prelissorhynchia* Xu & Grant (1994) and *Neowellerella* Dagys (1974). As a result of this revision, *Prelissorhynchia pseudoutah* (Huang) is interpreted to have a more restricted stratigraphical and geographical distribution than previously thought.

SINCE Huang (1933) proposed *Pugnax pseudoutah* for several Changhsingian specimens from Guizhou, South China, this species has been widely recognised in Late Permian to Early Triassic sequences of South China. As a result, this species has been considered to be one of the most common brachiopods of the Late Permian of the Tethyan Province (Liao 1987), and one of the characteristic elements of the so-called mixed Permian–Triassic boundary fauna in South China (Liao 1987). However, our review demonstrates that this species has been attributed to several different genera by various authors, including *Pugnax* Hall & Clarke (Huang 1933; Wang 1955; Wang et al. 1964; Jin & Liao 1974; Tong 1978; Feng & Jiang 1978; Zhan in Hou et al. 1979), *Neowellerella* Dagys (Jin et al. 1979; Liao 1979, 1980a, 1980b, 1981, 1982, 1984, 1987; Liao & Meng 1986; Zhan in Li et al. 1989), *Lissorhynchia* Yang & Xu (Xu in Yang et al. 1987) and *Prelissorhynchia* Xu & Grant (Xu & Grant 1994).

Huang (1933) did not fully describe the detailed internal features of the species, therefore leaving the generic position of the species open to interpretation. A broad definition of *Pugnax pseudoutah* Huang has been adopted by different authors, resulting in several unrelated specimens being referred to the species. For example the eastern Chinese specimens from the uppermost Permian to basal Triassic of Zhejiang and Fujian Provinces, described by Liao (1979, 1980a, 1980b, 1984), which possess a subpentagonal shape and a rather flat profile with a distinctive impression of a median ridge in the dorsal valve, belong to a distinct species. These specimens are different from others referred to the same species from Sichuan Province described by Xu (in Yang et al.

1987) and Xu & Grant (1994), in that the latter have a much thicker lateral profile, and are ornamented by rounded plicae, and lack a dorsal median ridge. In fact, both these collections are different from the type specimens of '*Pugnax*' *pseudoutah* Huang (1933: 64–66, pl. 10, figs 1–8) and belong to two separate species. *Pugnax pseudoutah* Huang is revised herein and placed in *Prelissorhynchia* Xu & Grant. However, the specimens, referred to *Prelissorhynchia pseudoutah* (Huang) by Xu & Grant (1994), are considered to represent a different species.

The specimens described in this paper were collected from the Huangzhishan section of Huzhou City, Zhejiang Province (Fig. 1, loc. 5) by the senior author in the summer of 1996. These specimens are externally closer to the type specimens of '*Pugnax*' *pseudoutah* Huang from Guizhou than any of the previously figured specimens under the same species name from elsewhere in South China. Comparison with the type specimens deposited in Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, was also undertaken for the present study.

STRATIGRAPHY OF THE NEW MATERIAL

The Huangzhishan section is located 30 km east of the Meishan section, Changxing, Zhejiang Province. This section has a continuous succession of marine Permian–Triassic boundary Beds (Fig. 2). The specimens were collected from Beds 11 and 12 of argillaceous limestones interbedded with mudstone (Fig. 2). The top of bed 12 is succeeded by a white clay bed, used extensively as a marker horizon for the Permian–Triassic boundary in South

China. Bed 12 itself is characterised by the appearance of a mixed fauna of Permian-like brachiopods and Triassic-like bivalves. Characteristic fusulinid species of the *Paleofusulina* Zone and conodont *Clarkina changxingensis* Zone occur lower in the section (Beds 1–2). Bed 10 yields the following brachiopods: *Peltichia* sp., *Paryphella orbicularis* Liao, *Leptodus nobilis* Waagen, *L. deminutus* Liao. Bed 11 is characterised by abundant brachiopods, including *Derbyia* sp., 'Waagenites' *quadrata* Zhan, 'W.' *longtanensis* Liao, 'W.' *soochowensis* Chao, *Lissochonetes* sp., *Neochonetes zhongyinensis* Liao, *N. convexa* Liao, *Chonetinella substrophomenoides* Huang, *Paryphella orbicularis* Liao, *P. triquetra* Liao, *Haydenella buravasi* Grant, *H. kiangsiensis* (Kayser),

Spinomarginifera alpha Huang, *S. kueichowensis* Huang, *S. chengyaoyensis* Huang, *Martinia* sp., *Crurithyris speciosa* Wang, *C. flabelliformis* Liao, *Uncinunellina* sp., *Prelissorhynchia pseudoutah* (Huang). Bed 12 contains the brachiopods *Acosarina strophilra* Xu., 'Waagenites' *pignaea* (Liao), 'W.' *quadrata* Zhan, *Spinomarginifera kueichowensis* Huang and *Prelissorhynchia* sp. Beds 13 and 14, a white clay bed and a black mudstone respectively, correlate with the White Clay bed (Bed 25) and Black Clay bed (Bed 26) of the Meishan section respectively. At Meishan, the currently widely accepted Permian–Triassic boundary is placed at the base of Bed 27b according to the evolutionary succession of conodonts (Yin 1994; Wang 1994). Therefore, the

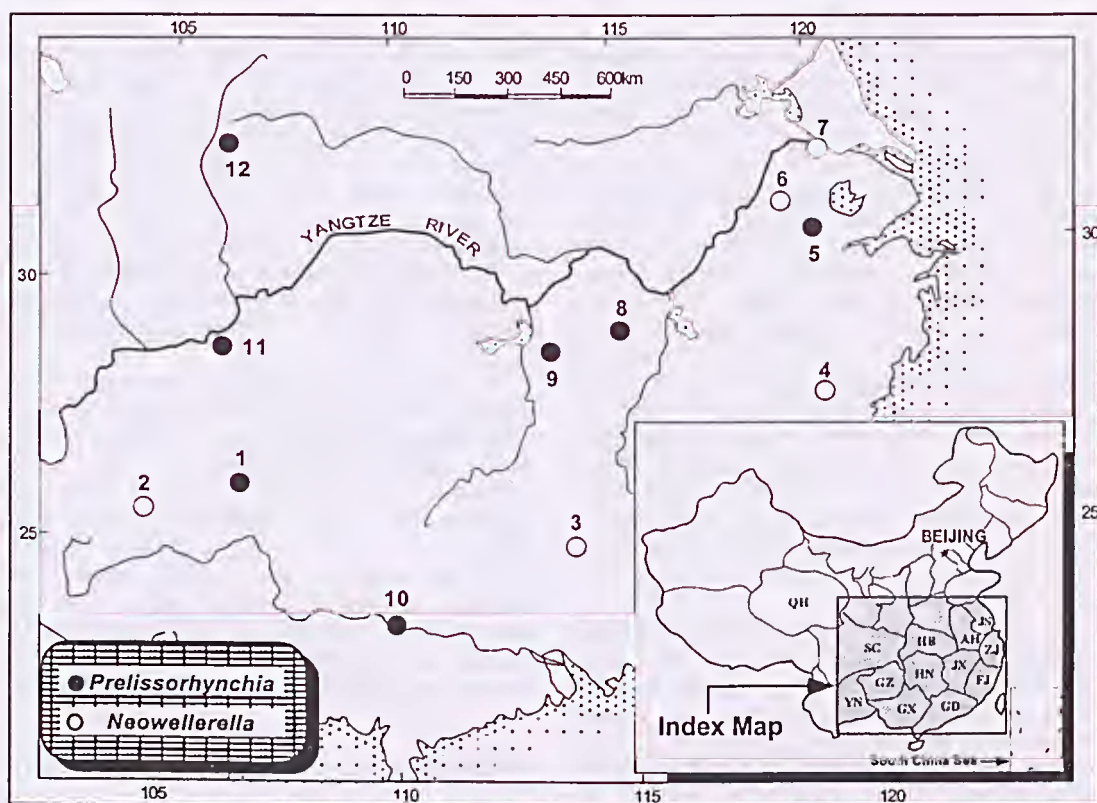


Fig. 1. The map showing the localities of *Prelissorhynchia* Xu & Grant (1994) and *Neowellerella* Dagens (1974) in South China. QH: Qinghai Province; SC: Sichuan Province; HB: Hubei Province; HN: Hunan Province; YN: Yunnan Province; GZ: Guizhou Province; GX: Guangxi Province; GD: Guangdong Province; JX: Jiangxi Province; FJ: Fujian Province; ZJ: Zhejiang Province; JS: Jiangsu Province; AH: Anhui Province. 1: Tatinghsien section, Anshuan County, GZ; 2: Zhongyin section, Qinglong County, GZ; 3: Shuizutang section, Lian County, GD; 4: Fushi section, Yongding County, FJ; 5: Huangzhishan Section, Huzhou City, ZJ; 6: Meishan section, Changxing County, ZJ; 7: Longtan section, Nanjing City, JS; 8: Huatang section, Chengxian County, HN; 9: Meitian section, Yizhang County, HN; 10: Matan section, Heshan City, GX; 11: Banzhuyuan section, Nantong County, SC; 12: Shangsi section, Guangyuan County, SC.

Permian-Triassic boundary at the Huanzhishan section should be drawn approximately at the top of the black mudstone (Bed 14) (Fig. 2). The following fossils, including the ammonoid *Ophiceras* sp., bivalve *Claraia* sp., and brachiopods *Lingula fuyuanensis* Liao and *Paracrurithyris pigmaea* Liao, are found in Beds 15-17. These elements are common in the Changhsingian and Griesbachian in South China.

The specimens studied and figured in this paper are deposited in the following institutions: the Nanjing Institute of Geology and Palaeontology, Academia Sinica, China (NIGP) and the Museum of Victoria, Melbourne (NMV).

Phylum BRACHIOPODA

Subphylum RHYNCHONELLIFORMEA Williams, Carlson, Brunton, Holmer & Popov, 1996

Class RHYNCHONELLATA Williams, Carlson, Brunton, Holmer & Popov, 1996

Order RHYNCHONELLIDA Kuhn, 1949

Suborder RHYNCHONELLIDINA Muir-Wood, 1955

Superfamily WELLERELLOIDEA Xu & Liu, 1983

Family PONTISIDAE Cooper & Grant, 1976

Genus *Prelissorhynchia* Xu & Grant, 1994
(emend herein)

Type species. *Pugnax pseudoutah* Huang, 1933.

Diagnosis. Small in size; subtriangular in outline, slightly wider than long; unequally biconvex; anterior commissure strongly uniplicate. Ventral valve slightly convex, with a pronounced sinus developed in anterior part; beak suberect or slightly incurved; deltidial plates strongly convex with a conspicuous median fold. Plicae angular, few and simple, separated by subangular valleys, originating at midvalve, and confined to the anterior part of the shell; two plicae within the sulcus, and three on the fold. Ventral interior with large knob-like teeth; dental plates strong and subparallel anteriorly. Dorsal interior with cardinal plate, crura falseifer-shaped; socket ridges strong, inclined over smooth sockets; inner hinge plate forming bridge, often convex (Fig. 3); median septum absent, but myophragm or thick secondary swelling well developed, serving median ridge anteriorly.

Comparison and discussion. *Neowellereella* Dagys (1974) shares dorsal internal features with the present genus, but is parasulcate at its anterior commissure and has fewer plicae near the anterior margin and much flattened shells.

Pontisia Cooper & Grant (1969) also develops very similar external and internal features like those of *Prelissorhynchia*, but differs in having somewhat flattened, rather than convex valves, rounded and longer but finer eostae originating from near the beak, and an elongate-oval foramen. Internally, *Pontisia* has a pair of smaller teeth within the ventral interior.

Tautosia Cooper & Grant (1969) is generally transverse in outline, with a strong fold and a deep sulcus, and is usually paucieostate, therefore suggesting close resemblance to the present genus, but *Tautosia* has a strong median septum in the dorsal interior.

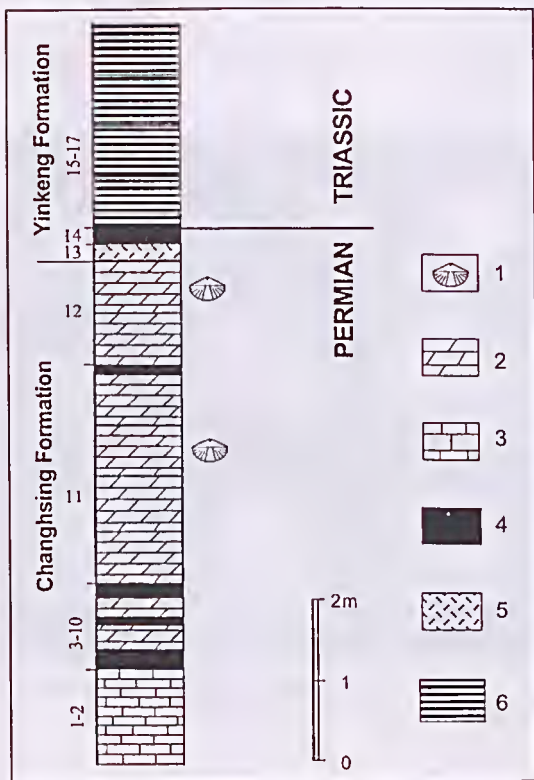


Fig. 2. The stratigraphic distribution of *Prelissorhynchia* Xu & Grant, 1994 in the Huangzhishan section. 1: *Prelissorhynchia* horizons; 2: argillaceous limestone; 3: limestone; 4: black shale; 5: white clay bed; 6: calcareous mudstone.

SYSTEMATIC PALAEOLOGY

The supra-ordinal classification follows the revision prepared for the new Treatise by Williams et al. (1996). All morphological terms are from Williams et al. (1965) and Brunton et al. (1996).

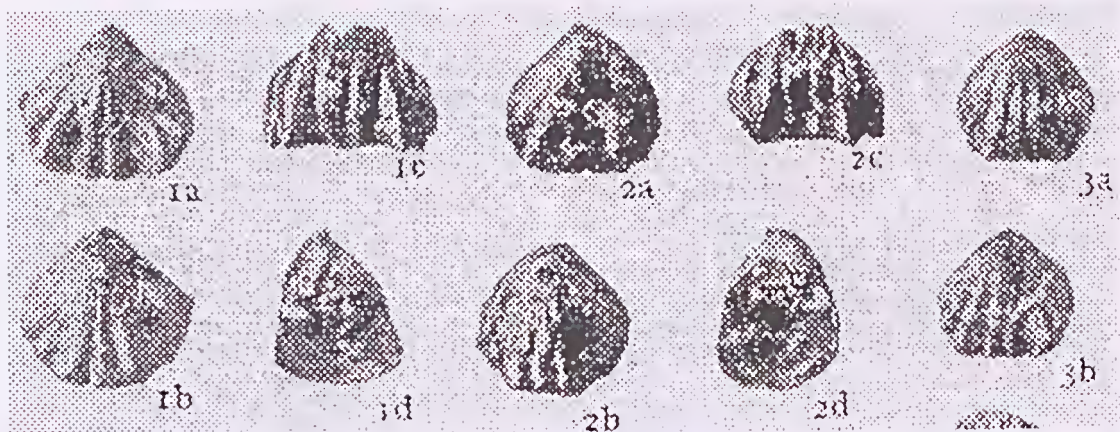


Fig. 3. The type specimens of *Prelissorhynchia pseudoutah* (Huang) from the Upper Permian of Guizhou Province, South China (after Huang 1933: 64–66, pl. 10, figs 1–3).



Fig. 4. The type specimens of *Prelissorhynchia xui* sp. nov. from the Upper Permian of the Baizhuyuan section of Nantong County, Sichuan Province, South China (after Xu & Grant 1994: 38, fig. 22: 28–48).

Externally, the present genus may be confused with *Pugnax* Hall & Clarke (1893) with which it shares many external features. However, *Pugnax* possesses separated hinge plates and the crura are supported by crural plates. In contrast, *Prelissorhynchia* has relatively longer, crescentic crura, and lacks a median septum in both valves. The present genus is also externally close to the Triassic genus *Rhynchonella* Fischer de Waldheim (1809), especially in outline and pattern of plication, but the latter is characterised by a dorsal septalium supported by a low median septum.

More recently, Xu (in Yang et al. 1987) allied the species name *pseudoutah* to the specimens from Hunan Province (Fig. 1, loc. 9), and referred the species to *Lissorhynchia* Yang & Xu (1966). Later, Xu & Grant (1994) erected a new genus, *Prelissorhynchia*, for material from Sichuan Province and they nominated *Pugnax pseudoutah* Huang as the type species. In the same paper, Xu & Grant assigned specimens from the Banzhuyuan section of Sichuan Province (Fig. 1, loc. 11) to *Prelissorhynchia pseudoutah*. The Sichuan and Hunan material (Fig. 4), as figured by Xu (in Yang

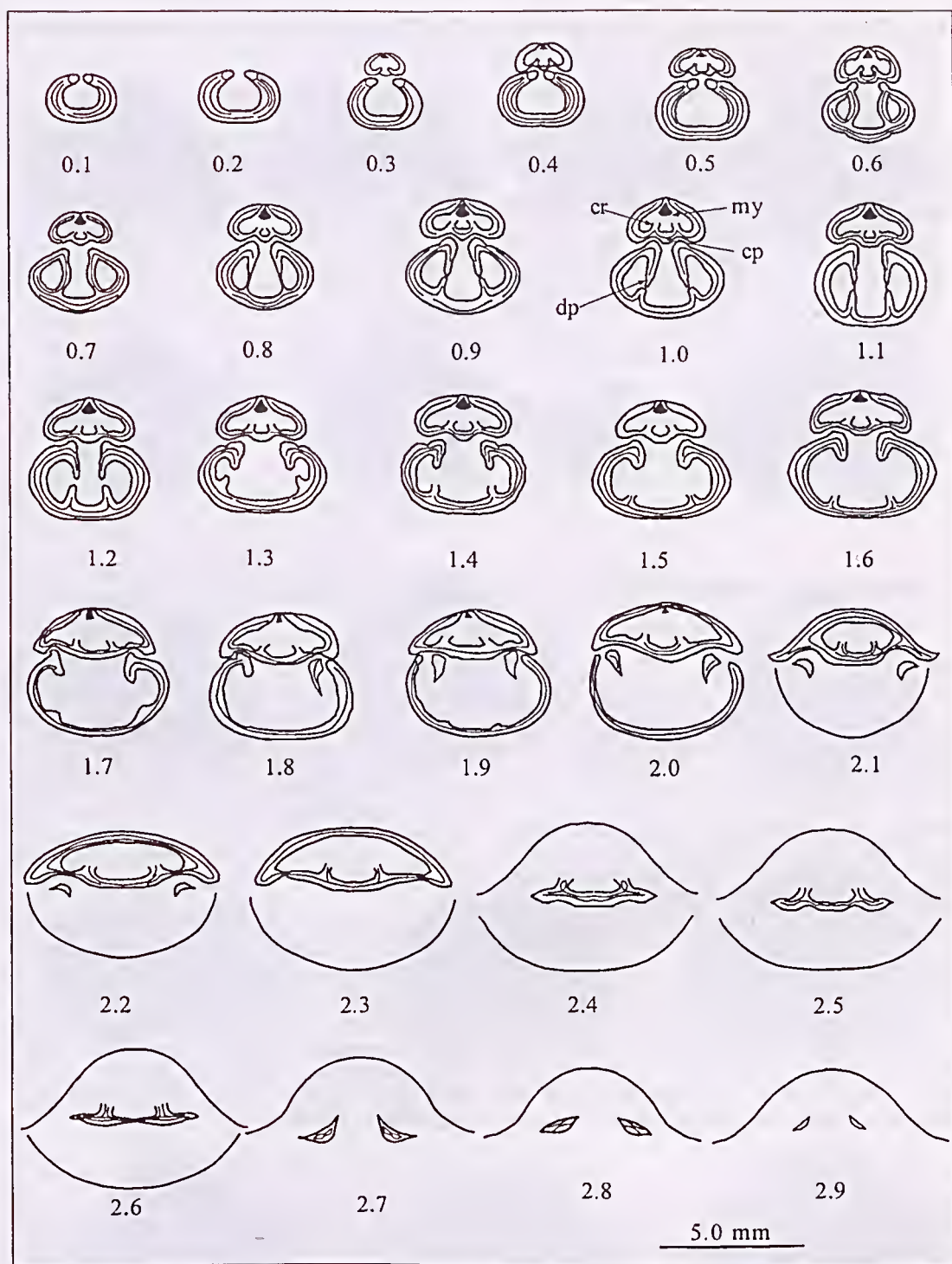


Fig. 5. Serial sections of *Prelissorhynchia pseudoutah* (Huang) (based on specimens NMV P149268), showing the internal features. The numbers are the distance from the beak, the orientation of the sections is with ventral valve down, the below horizontal line represents the scale. dp: dental plates; cp: cardinal plate; cr: crura; my: myophragm.

et al. 1987) and Xu & Grant (1994) respectively, is significantly different from the type specimens (Fig. 5) of '*Pugnax*' *pseudoutah* from Guizhou Province as originally described and figured by Huang (1933), in that they appear to represent two mutually distinguishable species. Consequently, the specific assignment of these specimens described by Xu & Grant (1994) is questionable. For these reasons, the diagnosis of the genus, *Preliissorhynchia* Xu & Grant, is emended herein based on a careful examination of our collection and the type specimens of Huang's species, housed in Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences. The low but distinctive myophragm is observed in the dorsal interior of *Preliissorhynchia* Xu & Grant.

Some specimens hitherto named *Neowellerella pseudoutah* (Huang) by Liao (1979, 1980a, 1980b, 1984) are also distinguishable from typical '*Pugnax*' *pseudoutah* Huang (1933). These specimens are revised below.

Preliissorhynchia pseudoutah (Huang, 1933)

Fig. 6A–F, H–J, L–R

Pugnax pseudoutah Huang 1933: 64–66, pl. 10, figs 1–8.—Wang 1955: 134, pl. 73, figs 13–16.—Wang et al. 1964: 396–397, pl. 66, figs 12–15.—Jin & Liao 1974: 312, pl. 165, figs 7–9.—Feng & Jiang 1978: 272, pl. 101, fig. 3.

Neowellerella pseudoutah.—Liao & Meng 1986: pl. 4, fig. 7.—Liao 1987: 108, pl. 5, fig. 29; pl. 8, fig. 1.

Lectotype. *Pugnax pseudoutah* Huang, 1933: 64–66, pl. 10, figs 1a–d. A specimen (Cat. 4728a) with two valves conjoined from the coal-bearing beds (Lungtan Formation; Wuchiapingian) of Jiazishan section of Anshuan County, Guizhou Province (Fig. 1, loc. 1), kept in the Nanjing Institute of Geology and Palaeontology, Academia Sinica (selected herein).

Discussion. When Huang (1933) first described the species, he figured three specimens (NIGP 4728a–c) as syntypes without designating a holotype. Among these syntypes, specimen NIGP 4728a is most clearly illustrated and is selected herein as the lectotype of *Preliissorhynchia pseudoutah* (Huang).

Xu & Grant (1994) and previous authors did not select a lectotype for the species.

Material. Twenty-five articulated shells from Bed 11 of the Changhsing Formation of the Huangzhishan section (Fig. 2) were studied. Of these, six are figured herein (NIGP 130585–90); NMV P149267–9 were serially sectioned in order to study the internal features.

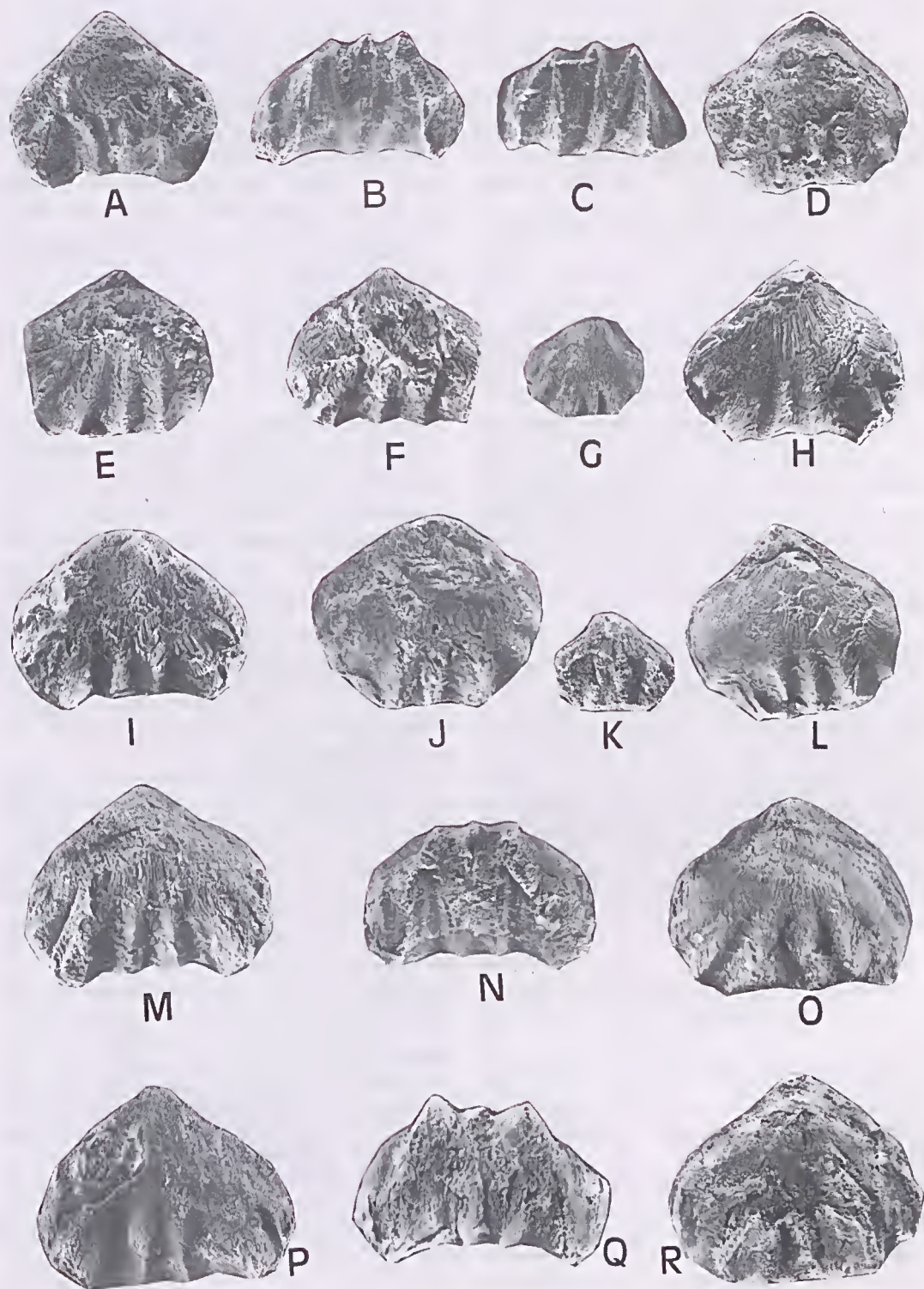
Measurements (in mm)

Specimen	Width	Length	Thickness	Apical angle
NIGP 130585	6.5	5.0	6.0	95°
NIGP 130586	6.8	5.0	6.5	105°
NIGP 130587	6.0	4.8	5.8	112°
NIGP 130588	7.0	5.8	7.0	115°
NIGP 130589	7.0	6.0	7.0	117°
NIGP 130590	7.8	6.2	7.1	113°
NMV P149267	7.0	5.0	5.5	95°
NMV P149268	7.0	6.0	5.0	112°
NMV P149269	6.0	5.0	5.0	108°

Diagnosis. Small-sized *Preliissorhynchia*; outline roundly to transversely triangular; unequally biconvex; profile narrowly subtriangular; anterior commissure strongly uniplicate; dorsal fold beginning at midvalve, furnished with three pliaeae; ventral sulcus deep, originating at midvalve, ornamented by two pliaeae. Ventral interior with strong and large knob-like teeth; dental plates strong and subparallel anteriorly, extending to about midvalve. Dorsal interior with cardinal plate; crura falcifer-shaped; socket ridges strong and high; inner hinge plate forming bridge, often convex; median septum absent, but myophragm or thick secondary swelling well developed, serving median ridge anteriorly.

Description. Shell very small (see measurements above); outline roundly to transversely triangular; unequally biconvex, dorsal valve more convex than ventral valve; apical angle between 95–117°; profile narrowly subtriangular; anterior commissure strongly uniplicate; dorsal fold beginning at midvalve, increasing in height to anterior margin, profile of fold strongly convex; ventral sulcus deep, originating at midvalve.

Fig. 6. A–F, H–J, L–R, *Preliissorhynchia pseudoutah* (Huang). A, D, NIGP 130585, ventral and dorsal views; B, H, L, NIGP 130586, anterior, ventral and dorsal views; C, E, F, NIGP 130587, dorsal and ventral views; I, J, NIGP 130588, ventral and dorsal views; M, N, O, NIGP 130589, ventral, anterior and dorsal views; P, Q, R, NIGP 130590, ventral, anterior and dorsal views. All $\times 5$. G, K, *Preliissorhynchia* sp., NIGP 130595, ventral and dorsal views. All $\times 3$. All specimens come from the top of Changhsing Formation of Huangzhishan Section, Huzhou, Zhejiang (Fig. 1, loc. 5).



Ventral valve slightly inflated posteriorly, becoming broadly and gently concave anteriorly; flanks slightly to strongly reflexed, lateral profile gently convex; beak well pointed, slightly incurved, and slightly elevated above dorsal beak; foramen small and triangular. Dorsal valve strongly convex from beak to anterior margin, umbo slightly flattened; apex concealed by ventral beak, covered by delthyrium; flanks moderately convex.

External surface of shells ornamented by about 6–7 simple plicae, originating at midvalves, confined to anterior part of shell, crests angular, separated by subangular valleys; fold with three angular plicae, separated by two deep valleys corresponding to the two plicae of sulcus; two low and sometimes ill defined plicae present on each flank; anterior commissure typically W-shaped. External surface of shells marked by very fine, irregular radial striations.

Ventral interior with strong and large knob-like teeth; dental plates strong and subparallel anteriorly, extending to about midvalve. Dorsal interior with cardinal plate; crura falcifer-shaped; socket ridges strong and high, inclined over smooth sockets; inner hinge plate forming bridge, often convex; median septum absent, but myophragm or thick secondary swelling well developed, serving median ridge anteriorly (Fig. 5).

Discussion. Our specimens (Fig. 6) are comparable with the type specimens (Fig. 3) of *Prelissorhynchia pseudoutah* (Huang 1933) in most aspects. Hence, we refer these specimens to *P. pseudoutah*. This species is described and illustrated herein because of the lack of details in Huang's (1933) original description. Although the species name *pseudoutah* has been variably applied to specimens from many different South Chinese faunas, some of these specimens can be readily discriminated from the type specimens figured herein (Fig. 3), and also figured by Huang (1933: pl. 10, figs 1–8).

Tong (1978: 241–242, pl. 85, figs 11a–c) described and figured a specimen as *Pugnax pseudoutah* from the Changhsingian of the Yakou section of Puzimiao, Pengshui County, Sichuan, but this specimen possesses divided hinge plates in the dorsal interior, unlike the undivided hinge plate of *Prelissorhynchia pseudoutah*. Therefore, it is probably a new species of *Pugnax* Hall & Clarke rather than a *Prelissorhynchia*.

Jin et al. (1979: 105, pl. 30, figs 6–9) figured several specimens as *Neowellerella* cf. *pseudoutah* (Huang). These specimens possess similar external features to Huang's material, but lack dental plates in the ventral interior and convex inner hinge

plates in the dorsal interior, indicating significant differences from Huang's species. These specimens probably represent a new genus of Wellerellidae.

Zhan (in Hou et al. 1979: 95, pl. 8, figs 21–22) described and figured a specimen from the Shuizutang section of Lian County of northern Guangdong Province (Fig. 1, loc. 3) under the name of *Pugnax pseudoutah* Huang. The Guangdong specimen possesses longer, rounded costae within the sulcus, and is also different from typical *Prelissorhynchia pseudoutah* (Huang) in having an elongate triangular outline. The Guangdong material is probably a species of either the *Stenosclimatidae* or ?*Neowellerella*.

Liao (1979: pl. 1, fig. 11; 1980a: pl. 1, figs 10–11; 1982: 235, pl. 96, figs 18–19; 1984: pl. 2, fig. 24) figured several specimens as *Neowellerella pseudoutah* (Huang) from the Early Triassic Yinkeng Formation of the Mcishan section of Changxing, Zhejiang Province (Fig. 1, loc. 6), also from the Late Permian Talung Formation of Yongding, Fujian Province (Fig. 1, loc. 4), and from the Longtan section of Nanjing, Jiangsu Province (Fig. 1, loc. 7). Liao's specimens possess a subpentagonal outline and low convexity in both valves. The ventral sulcus originates at the beak, and bears two weak plicae separated by a weak shallow median trough. These features show that these eastern Chinese brachiopods are very different from the typical specimens of *Prelissorhynchia pseudoutah* (Huang); they probably belong to a new species of either *Neowellerella* Dagys or *Prelissorhynchia* Xu & Grant depending on their internal features.

The Changhsingian specimen of the Zhongyin section in Qinglong County of Guizhou Province (Fig. 1, loc. 2), also named as *N. pseudoutah* (Huang) by Liao (1980a: pl. 2, figs 1–2; 1980b: pl. 7, figs 38–39), has low convexity in both valves and concentric lamellae on the anterior of the umbonal region, unlike the lectotype of this species. On the other hand, this Guizhou specimen resembles and may prove to be conspecific with some eastern Chinese specimens figured by Liao (1979, 1980a, 1980b, 1984) as discussed above. It is worthy noting that both the specimens from eastern China and Guizhou figured by Liao are readily distinguishable from *Prelissorhynchia pseudoutah* of Xu & Grant (1994: 38, fig. 22: 28–48) in having a low convex profile and weak plicae on both valves.

Specimens referred to as *Lissorhynchia pseudoutah* (Huang) by Xu (in Yang et al. 1987: 229, pl. 13, figs 15–16; pl. 14, figs 10–12) and as '*Prelissorhynchia pseudoutah* (Huang)' by Xu & Grant (1994) are both very different from the type

material of *Prelissorhynchia pseudoutah* (Huang). These specimens represent two distinct genera as correctly and appropriately named by Xu (in Yang et al. 1987) as *Lissorhynchia* and by Xu & Grant (1994) as *Prelissorhynchia*. However, they are unable to be referred to as *Prelissorhynchia 'pseudoutah'* (Huang), which is herein renamed *Prelissorhynchia xui* sp. nov. (see next) (Table 1).

Neowellereia pseudoutah of Zhan (in Li et al. 1989: pl. 26, figs 9–11) from the Late Permian Talung Formation of the Shangsi section in Guangyuan, Sichuan (Fig. 1, loc. 12) is less inflated in profile and has low, rounded costae, a shallow median sulcus and low median fold, suggesting resemblance to the Sichuan specimens of Xu & Grant (1994) rather than to Huang's type material of *Prelissorhynchia pseudoutah*.

The Hunan specimens from the Huatang section of Chengxian County (Fig. 1, loc. 8) (Liao & Meng 1986: pl. 4, fig. 7) and the siliceous specimens from the Late Permian Talung Formation of the Matan section of Laibin, Guangxi (Fig. 1, loc. 10) (Liao 1987: 108, pl. 5, fig. 29; pl. 8, fig. 1) seem to be referable to *Prelissorhynchia pseudoutah* (Huang) as described herein because they all have similar external and internal features.

Waterhouse (1983: 131–132, pl. 4, figs 4–5) also compared Huang's species with specimens from Thailand. The Thai species has longer and more flattened valves, and is perhaps more closely related to a member of *Stenosclimatidina*, as also suggested by Waterhouse.

In summary, specimens previously assigned to '*Pugnax pseudoutah*' Huang from the Late Permian to the Early Triassic of South China can be approximately referred to three separate taxa (Table 1). The material from Guizhou (Huang 1933; Wang 1955; Wang et al. 1964; Jin & Liao 1974; Feng & Jiang 1978), Hunan (Liao & Meng 1986), Guangxi (Liao 1987), and the specimens described herein from Zhejiang are considered to be conspecific with Huang's (1933) original specimens. The specimens from the mixed beds of the Permian–Triassic boundary of Jiangsu, Zhejiang and Fujian Provinces (Liao 1979, 1980a: pl. 1, figs 10–11; 1981, 1984) and Guizhou (Liao 1980a: pl. 2, figs 1–2; 1980b) represent a new species, but its generic position is indeterminable due to poor knowledge of the internal structures. The Sichuan material figured by Xu (1987), Zhan (1989), Xu & Grant (1994) is assigned to *Prelissorhynchia xui* sp. nov. The specimen from the Changhsingian of the Yakou section of Puzimiao, Panshui County, Sichuan Province (Tong 1978: 241–241, pl. 85, figs 11a–c) probably represents a new species of *Pugnax* Hall & Clarke. The Qinghai material

figured and studied by Jin et al. (1979) is probably a new species of a new genus of the Wellerellidae.

Prelissorhynchia sp.

Fig. 6G, K

Material. NIGP 130595, one complete specimen with two valves conjoined from bed 12 of the Huangzhishan section, Huzhou City, Zhejiang Province.

Measurements (in mm). Maximum width: 5.5; length: 3.9; thickness: 4.8; apical angle: 108°.

Description. Small in size; subtriangular in outline; unequally biconvex, greatest width near anterior of shell; postero-lateral margins gently concave; anterior margin truncate, anterior commissure uniplicate; median sulcus and fold pronounced, originating at midvalve. Surface semicostate, costae strong and distinct, beginning at midvalve; three costae on fold, two in sulcus.

Ventral valve moderately convex; gently convex in lateral profile but deeply concave in anterior profile; median sulcus deep; flanks narrow, concave, with costae. Dorsal valve strongly convex in lateral profile, more inflated than ventral valve with greatest convexity near anterior margin; anterior profile strongly domed with gently rounded top but steep flanks. Fold highly convex; flanks depressed and narrowly rounded. Internal structures unknown.

Discussion. This specimen is indicative of another species of *Prelissorhynchia* in the present collection. It is comparable to *H. pseudoutah* (Huang), but differs in having rather compressed valves and a deeply concave, broadly rounded postero-lateral margin in the dorsal valve. This specimen is also different from the material from Fujian, Zhejiang and Jiangsu Provinces studied by Liao (1979, 1980b, 1984) in possessing a deep sulcus with conspicuous median plicae. It is likely that the present specimen represents a new species.

Prelissorhynchia xui sp. nov.

Fig. 4

Lissorhynchia pseudoutah (Huang).—Xu in Yang et al. 1987: 229, pl. 13, figs 15–16; pl. 14, figs 21–22.

Prelissorhynchia pseudoutah (Huang).—Xu & Grant 1994: 38, fig. 22: 28–48; fig. 23.

Holotype. Figured by Xu & Grant 1994: 38, fig. 22: 43–46. A specimen (USNM 456064b) with two valves conjoined from the Late Permian deposits of Baizhuoyuan section of Nantong, Sichuan Province (Fig. 1, loc. 11), kept in the National Museum of Natural History, Smithsonian Institution, Washington, DC.

Species	Age	Locality (see Fig. 1)	Author	Revised herein
<i>Pugnax pseudoutah</i> Huang	Changhsingian	GZ	Huang (1933) Wang (1955) Wang et al. (1964) Jin and Liao (1974) Feng and Jiang (1978)	
<i>Neowellerella pseudoutah</i> (Huang)	Changhsingian	HN	Liao and Meng (1986)	<i>Prelissorhynchia pseudoutah</i> (Huang)
<i>N. pseudoutah</i> (Huang)	Changhsingian to Early Triassic	GX	Liao (1987)	
<i>Lissorhynchia pseudoutah</i> (Huang)	Changhsingian	HN	Xu (1987)	<i>Prelissorhynchia xui</i> sp. nov.
<i>N. pseudoutah</i> (Huang)	Changhsingian	SC	Zhan (1989)	
<i>Prelissorhynchia pseudoutah</i> (Huang)	Changhsingian	SC	Xu and Grant (1994)	
<i>N. pseudoutah</i> (Huang)	Changhsingian	GZ	Liao (1980a,b)	? <i>Neowellerella</i> sp.
<i>N. pseudoutah</i> (Huang)	Changhsingian to Early Triassic	ZJ	Liao (1979, 1980a)	
		FJ	Zhao et al. (1981)	
		JS	Wang et al. (1982) Liao (1984)	
<i>Pugnax pseudoutah</i> Huang	Changhsingian	GD	Zhan (1979)	? <i>Neowellerella</i> sp.
<i>Pugnax pseudoutah</i> Huang	Changhsingian	SC	Tong (1978)	? <i>Pugnax</i> sp.
<i>Neowellerella</i> cf. <i>pseudoutah</i> (Huang)	Late Permian	QH	Jin et al. (1979)	? ??

Table 1. Revision of species referred to *pseudoutah* Huang from the Late Permian to Early Triassic in South China.

Diagnosis. Small, subtriangular to subcircular, thick in lateral profile, semicostate, sulcus and fold commencing from somewhat anterior to midlength, costae rounded, 2 in sulcus, 3 on fold, 2–3 on each lateral side. Ventral interior with large, knob-like teeth; dental plates strong and subparallel extended. Dorsal interior with undivided hinge plate, but hinge plates separating socket ridges and crural bases, inner hinge plates forming arched bridge; sockets shallow, socket ridges low; crura crescentric; median septum absent.

Discussion. The detailed description has been provided by Xu & Grant (1994: 38, fig. 22: 28–48; fig. 23). The new species is similar to *Prelissorhynchia pseudotah* (Huang) in both external and internal features, but is easily separated from the latter by a subcircular outline with a greater shell thickness, higher shell convexity, and rounded plications. The low but distinctive myophragm is present at the dorsal interior of *Prelissorhynchia pseudotah* (Huang) (Fig. 5), but appears to be absent in the new species (Xu & Grant 1994: 38, fig. 23).

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